



NCID Organism to SNOMED Mapping Application: A Practical Tool to Achieve Lab Vocabulary's PHIN Compliance

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Presentation Outline

- **Introduction**
 - NCID STARLIMS implementation
 - SNOMED CT as a national recommended standard
- **NCID organism mapping issues**
- **NCID organism to SNOMED mapping tool**
- **Summary**



Benefits of Implementing Standardized Vocabularies

- **Support information sharing/interoperability**
 - Compliant with regulations/requirements
- **Capture institutional knowledge**
- **Help to reengineer business process**
- **Make data analysis easier**
 - Document management
 - Knowledge management



STARLIMS NCID Implementation

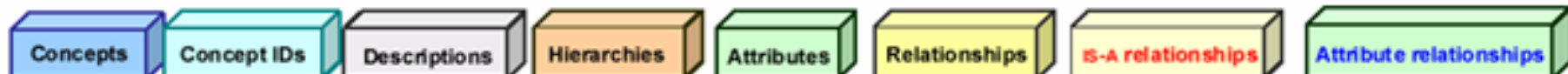
- STARLIMS is a commercial off the shelf (COTS) laboratory information management system
- NCID STARLIMS Implementation
 - Started in 2004
 - An enterprise laboratory information system
 - Adopt PHIN compliant Standards
 - HL7
 - SNOMED CT
 - LOINC



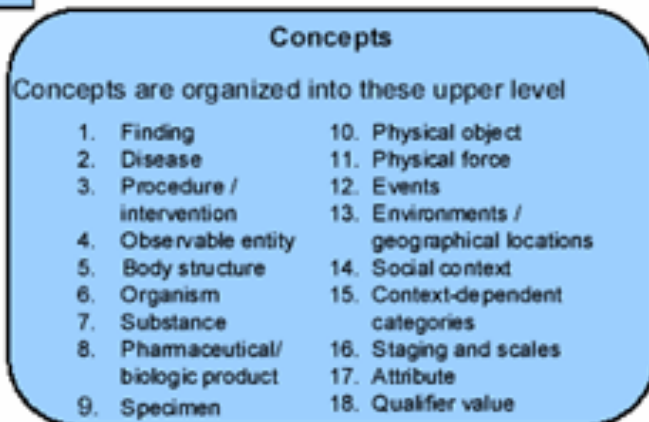
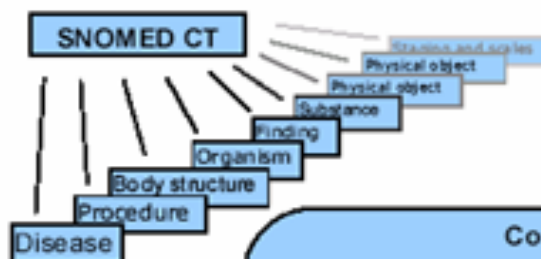
SNOMED CT

(Systemized Nomenclature of Medicine Clinical Terms)

- **A comprehensive clinical terminology that used to code, retrieve, and analyze clinical data**
- **Comprised of concepts, terms and relationships to precisely represent clinical information across the scope of health care**
- **Concepts are the basic units of SNOMED CT**
- **SNOMED CT is organized into hierarchies of concepts**
- **The January 2005 release contains 364,461 concepts, 399,755 preferred terms and 188,859 synonyms**
- **There are 25,888 organism concepts and 71,246 organism terms in January 2005 release**



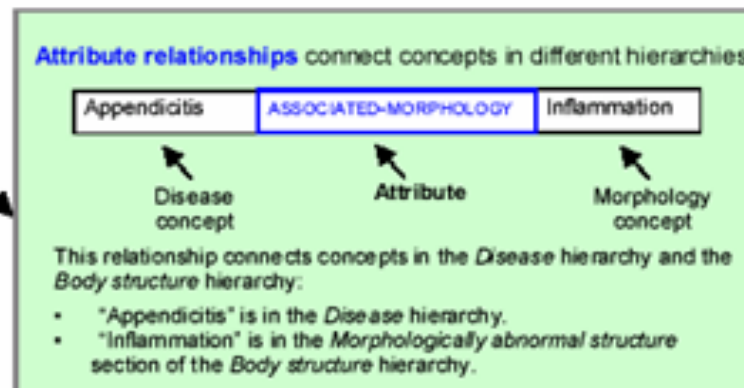
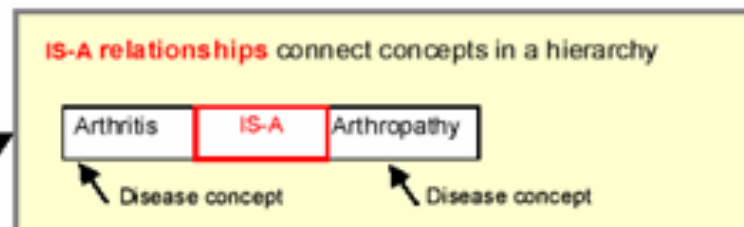
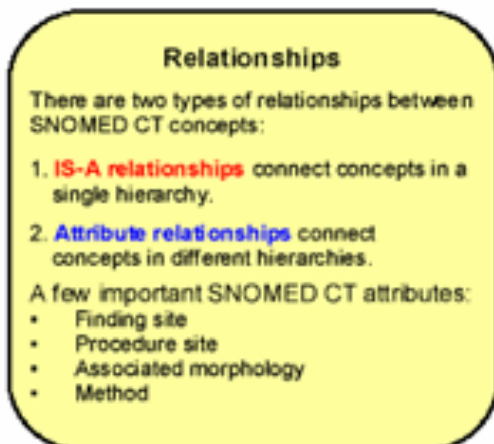
SNOMED CT[®] Components



67814005	Concept ID	Fully specified name
807580015	Bronchopneumonia (disorder)	
112640014	Bronchopneumonia	
112644017	Bronchial pneumonia	
112642018	Lobular pneumonia	
112643011	Bronchopneumonia	
IS-A		Pneumonia
ASSOCIATED-		Inflammation
FINDING-SITE		Lung structure
FINDING-SITE		Bronchial structure

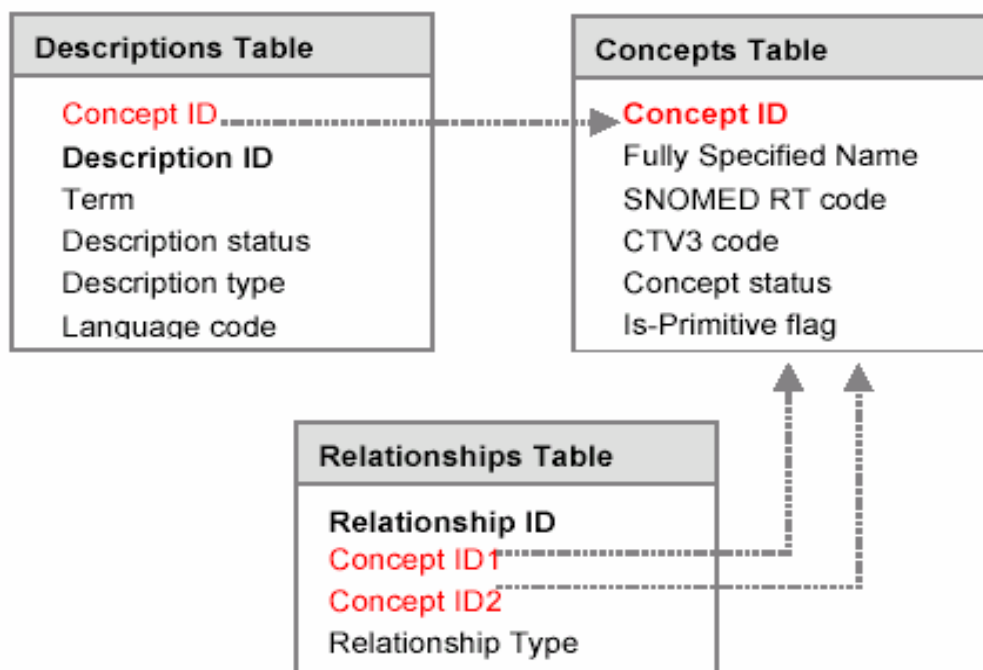


Example of hierarchy of is-a relationships





SNOMED CT Database



SNOMED CT database tables



SNOMED CT Concepts Table



ConceptID	Concept Status	FullySpecifiedName	CTV3ID	SNOMEDID	IsPrimitive
23496000	0	Fungus (organism)	X79pZ	L-40000	1
233604007	0	Pneumonia (disorder)	X100E	D2-0007F	0
274103002	6	Pneumonia NOS (disorder)	XM0rv	D2-0009B	1



SNOMED CT Descriptions Table

DescriptionID	Description Status	ConceptID	Term	Initial capital Status	Description Type	Language Code
753022014	0	23496000	Fungus (organism)	0	3	en
39449010	0	23496000	Fungus	0	1	en
1223107017	0	23496000	Fungi	0	2	en
39451014	0	23496000	Mycete	0	2	en

SNOMED CT Relationships Table

RelationshipID	ConceptID1	Relationship Type	ConceptID2	Characteristic Type	Refinability	Relationship Group
2689692020	23496000	116680003	36272005	0	0	0
	Fungus	IS-A relationship	Infectious agent			
2689693026	23496000	116680003	264395009	0	0	0
	Fungus	IS-A relationship	Microorganism			



NCID Organism Mapping Challenges and Solutions



- **NCID proprietary organism terms**
 - came from legacy systems like LITS Plus
 - Not well formatted
 - Not systematically classified
- **SNOMED CT not a prefect standardized vocabulary**
- **Mapping results reviewed by practicing lab microbiologists/NCID specialty expert group**
- **Informatics specialists, instead of making decisions, function as process facilitators in the final mapping decision making process**



Examples of a Proprietary Term Set Mapping Issues



- **Absidia Corymbifera**
 - Inferred as a bacterium
 - A fungal concept in SNOMED CT
- **Amycolatopsis orientalis**
 - In SNOMED CT: amycolatopsis orientalis ss orientalis
- **Gordonia rubropertincta**
 - In SNOMED CT: Gordona rubropertinctus



Examples of a Proprietary Term Set Mapping Issues



- Disease vs. causative agent: Tuberculosis
 - It is a disease concept in SNOMED CT
 - The causative agent should be mycobacterium tuberculosis
- Duplicated proprietary terms:
 - Nocardia dassonville (synonym in SNOMED CT)
 - Nocardiosis Dassoillei (preferred term in SNOMED CT)
 - SNOMED CT concept: nocardiosis dassonvillei



Concept Classification

Examples from a NCID Lab:

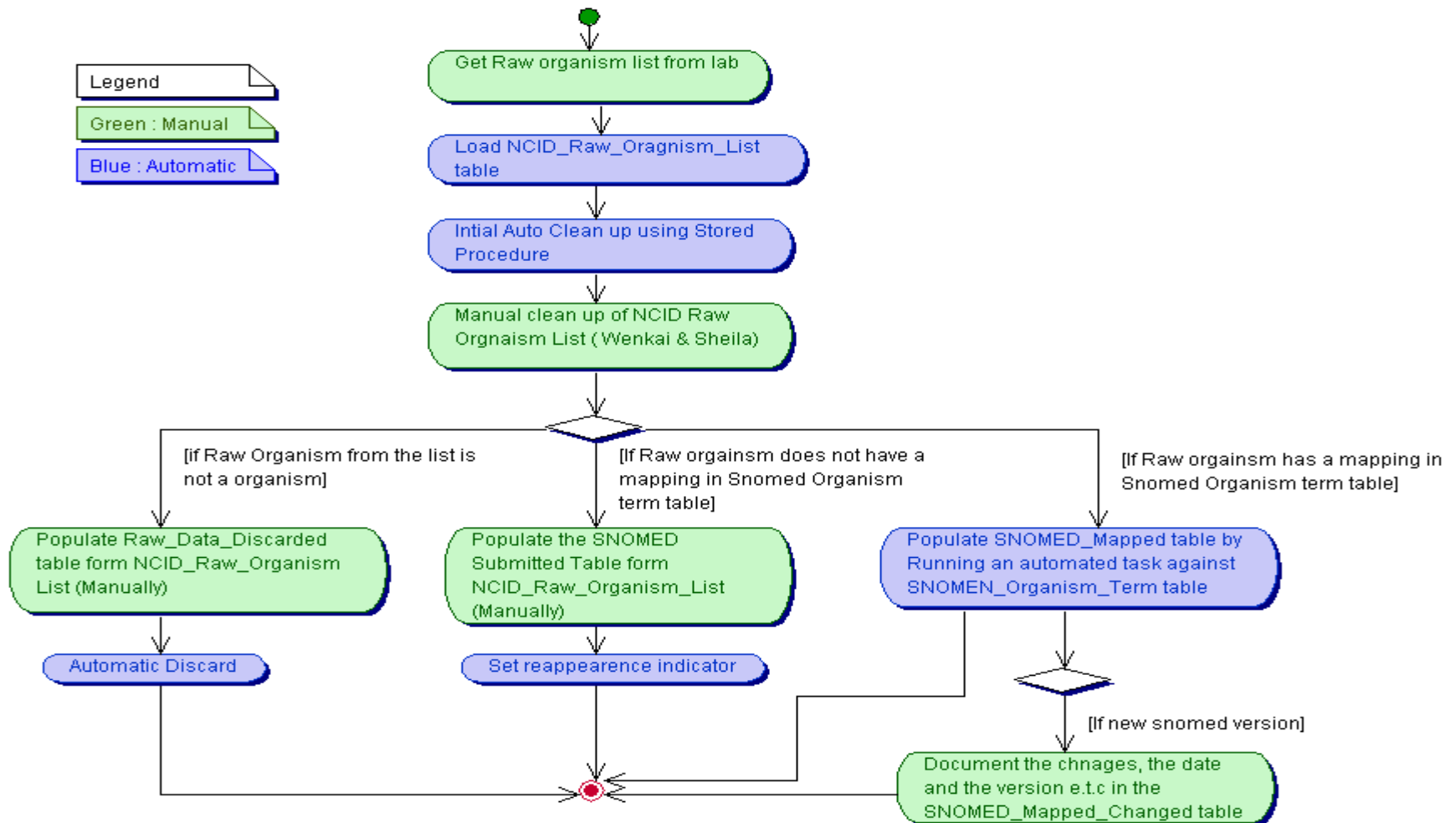
- Clonorchis/Opisthorchis/Heterophyes/
Metagonimus
 - SNOMED CT: Family
Opisthorchiidae??
- Egg
- Charcot-Leyden crystals
- OTHER_specify
- Remark_No Parasites Found
- Remark_Unacceptable Specimen



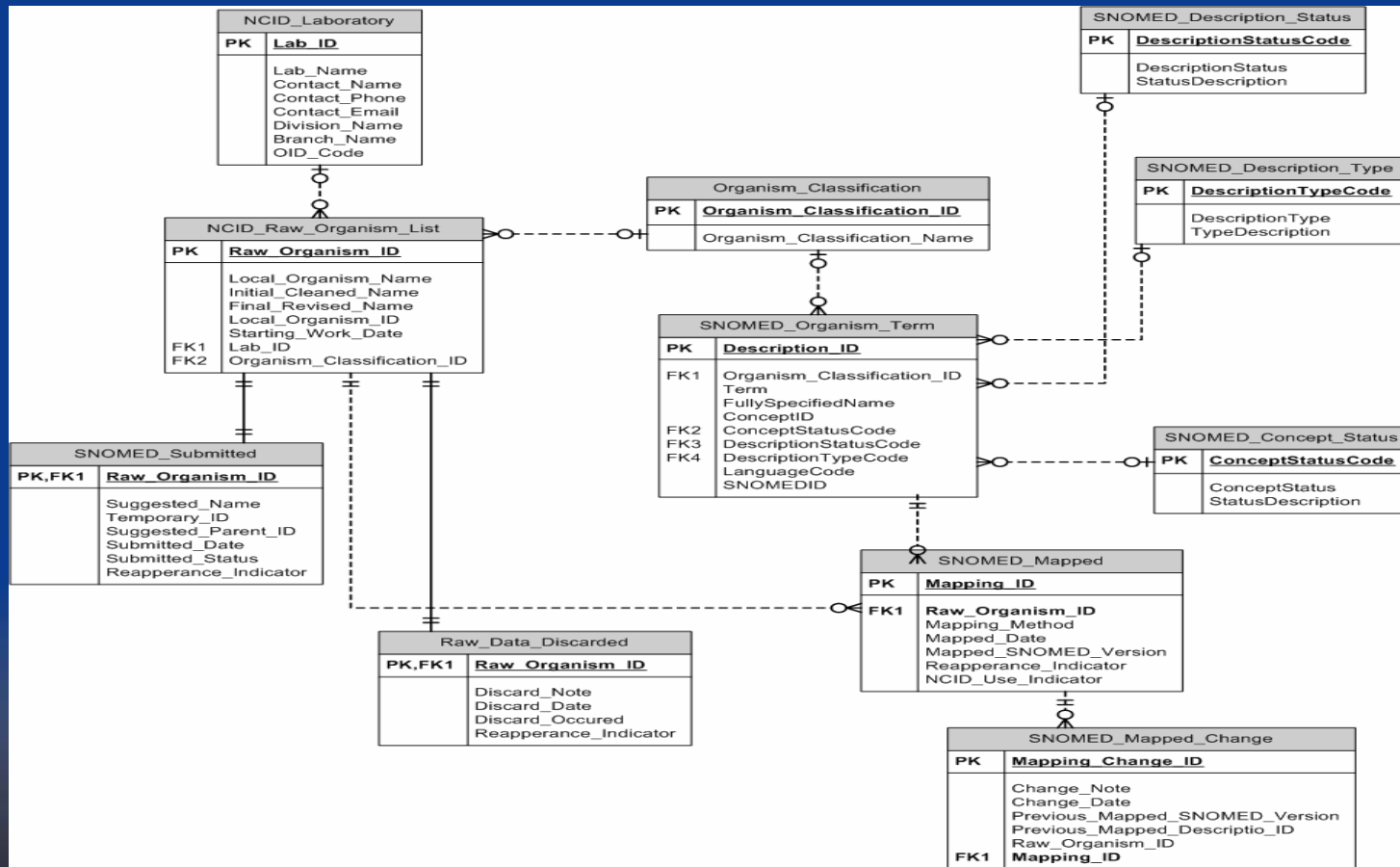
Supporting Tool is needed for the Organism Mapping Process

- To handle the larger number of terms
- To manage NCID legacy organism terms
- To maximize automation of the mapping process
- To document issues, notes and decisions during the mapping process
 - Discard proprietary terms
 - Submit new terms or concepts to SNOMED CT
- Support researches on the mapping results

Mapping Process Diagram



NCID Organism Mapping Database ER Diagram





Functions of the Mapping Tool



- Bulk load the subset of SNOMED CT organism description terms
- Bulk load and register an organism value set from a NCID laboratory
- Manually review and revise a NCID organism term and document the change as needed
- Automatically map a NCID organism value set against SNOMED CT organism subset



Functions of the Mapping Tool

- **Manually map NCID organism terms that can not be automatically matched against the SNOMED CT database**
- **Check the mapping results**
- **Track the organism term submission to SNOMED CT**
- **Assign a interim NCID organism ID to a organism term submitted to SNOMED CT**
- **Generate a SNOMED mapped organism value set for a particular laboratory module in the NCID StarLIMS implementation**



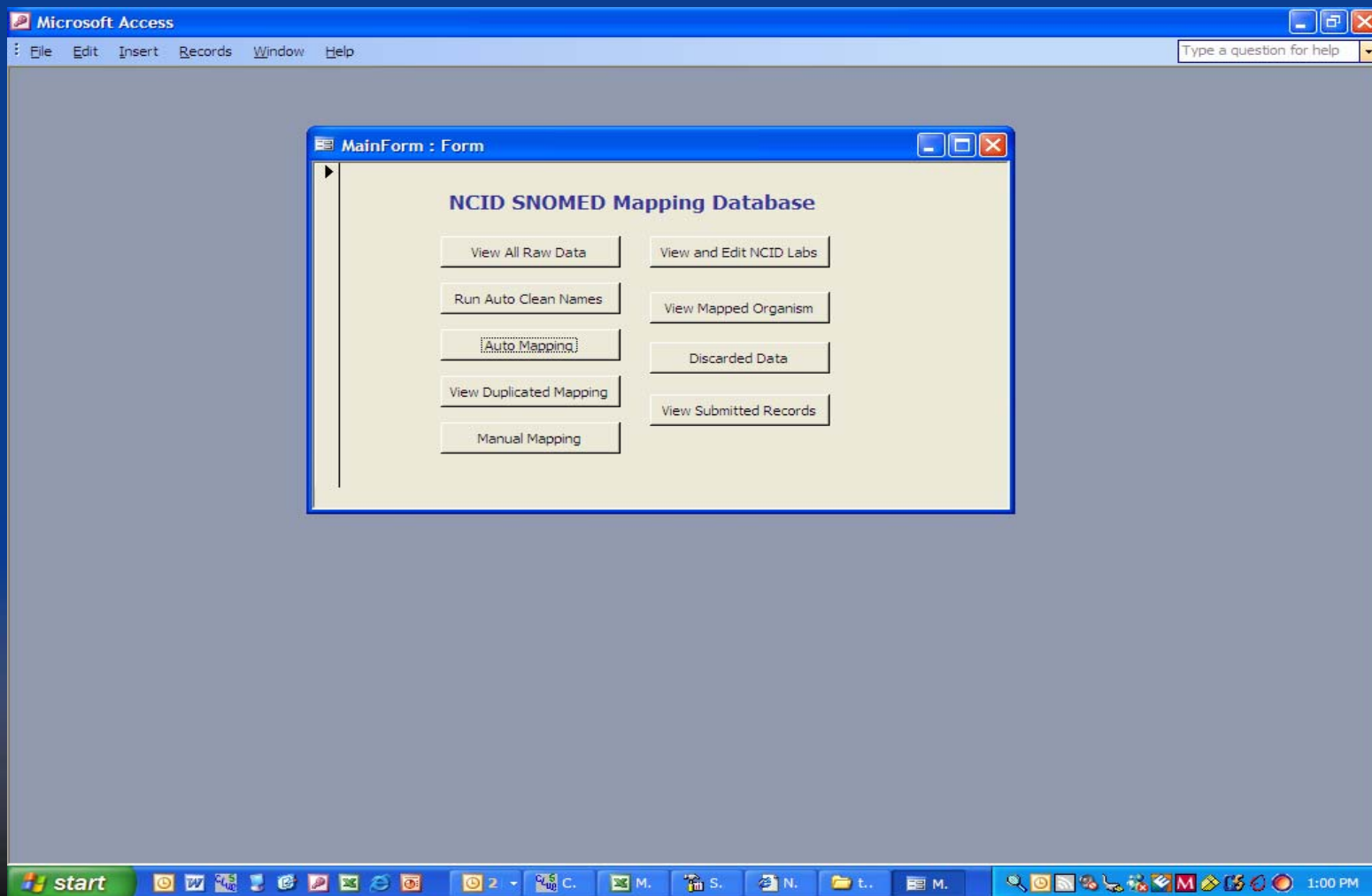
Technical Specifications of the Mapping Tool



- **Access through NCID network**
 - Limited security accesses by authorized users' CDC network user IDs and passwords
- **Backend database maintained in SQL server 2000**
- **Front end interfaces created by MS Access project (.ADP)**



Main Page



Register a NCID Lab

Microsoft Access - [NCID_Laboratory]

File Edit Insert Records Window Help

Type a question for help

NCID Laboratory

Lab ID	1
Lab Name	Morphology (52)
Contact Name	Dr. White
Contact Phone	770 488-8888
Contact Email	dwhite@cdc.gov
Division Name	Division of Parasitic Diseases
Branch Name	Parasitic Diseases
OID Code	
Creat Date	

Record: 1 of 3

Start | SNOMED | MainForm : Form | NCID_Laboratory

View Raw Data

Microsoft Access - [dbo_NCID_Raw_Organism_List]

Type a question for help

Raw_Organism_ID	Local_Organism_Name	Initial_Cleaned_Name	Fin	Lo	Sta	Lab	Organism_Classification_ID
123	Achromobacter spp	Achromobacter Species				1	
124	Achromobacter denitrificans					1	
125	Achromobacter insolitus					1	
126	Achromobacter (Alcaligenes) piechaudii					1	
127	Achromobacter ruhlandii					1	
128	Achromobacter spanius					1	
129	Achromobacter xylosoxidans					1	
130	Achromobacter group B					1	
131	Achromobacter group E					1	
132	Acidovorax spp	Acidovorax Species				1	
133	Acidovorax delafieldii					1	
134	Acidovorax faecilis					1	
135	Acidovorax temperans					1	
136	Acinetobacter spp	Acinetobacter Species				1	
137	Acinetobacter baumannii					1	
138	Acinetobacter baylyi					1	
139	Acinetobacter bouvetii					1	
140	Acinetobacter calcoaceticus					1	
141	Acinetobacter gernerii					1	
142	Acinetobacter grimontii					1	
143	Acinetobacter haemolyticus					1	
144	Acinetobacter johnsonii					1	
145	Acinetobacter junii					1	
146	Acinetobacter lwoffii					1	
147	Acinetobacter parvus					1	
148	Acinetobacter radioresistens					1	
149	Acinetobacter schindleri					1	

Record: 1 of 722

Start | SNOMED | MainForm : Form | dbo_NCID_Raw_Organ...

Check Duplicated Mappings

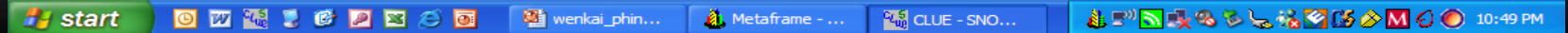
Microsoft Access - [duplicateMapping]

Type a question for help

Mapping_ID	Raw_Organism_ID	Mapping_Method	Mapped_D:	Mapped_SNOMED	Description_ID	Reapperanc
10035	641	Auto Mapping	3:32:00 PM		128957016	
Description_ID	Organism_Classification_ID	Term	FullySpecifiedName	ConceptID		
128957016	1	Neisseria flava	Neisseria subflava (organism)	77700001		
* 128957016						
10036	641	Auto Mapping	3:32:00 PM		193529011	
Description_ID	Organism_Classification_ID	Term	FullySpecifiedName	ConceptID		
193529011	1	Neisseria flava	Neisseria flava (organism)	125040002		
* 193529011						
10040	645	Auto Mapping	3:32:00 PM		128958014	
10041	645	Auto Mapping	3:32:00 PM		182528010	
10048	667	Auto Mapping	3:32:00 PM		170024016	
10049	667	Auto Mapping	3:32:00 PM		496034011	
10070	705	Auto Mapping	3:32:00 PM		182596015	
10071	705	Auto Mapping	3:32:00 PM		56626010	
10086	743	Auto Mapping	3:32:00 PM		133121019	
10087	743	Auto Mapping	3:32:00 PM		2160579012	
10097	763	Auto Mapping	3:32:00 PM		182275011	
10098	763	Auto Mapping	3:32:00 PM		39938010	
10106	775	Auto Mapping	3:32:00 PM		387892017	
10107	775	Auto Mapping	3:32:00 PM		81573018	
10110	778	Auto Mapping	3:32:00 PM		182625016	
10111	778	Auto Mapping	3:32:00 PM		494118013	
10164	844	Auto Mapping	3:32:00 PM		148356013	
10165	844	Auto Mapping	3:32:00 PM		832378015	
* (AutoNumber)						

Record: 1 of 1

Start | SNOMED | MainForm : Form | duplicateMapping





Keys to Standard Implementations

- Full understanding of an application's functional requirements
- Familiar with characteristics of relevant source standards
- Strong technical expertise
- Willing to play in a multidisciplinary team sport



Summary

- **The NCID Organism to SNOMED mapping application is a practical tool to make lab vocabulary compliant with PHIN specifications**
 - **Provided a centralized management of the organism to SNOMED mapping process**
 - **Increased the organism to SNOMED mapping efficiency and accuracy**
 - **Can be adapted with a little efforts to any other domains for SNOMED CT concept mappings**
 - **Piloting stage**
- **Further applicant improvements and function enhancements are underway**



Acknowledgments

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